(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 221 994 A1

(12) EUROPEAN PATENT APPLICATION

published in accordance with Art. 153(4) EPC

(43) Date of publication:
25.08.2010 Bulletin 2010/34

(21) Application number: **08852409.5**

(22) Date of filing: **17.10.2008**

(51) Int Cl.:
H04B 7/26 *(2006.01)* ***H04L 27/00*** *(2006.01)*

(86) International application number:
PCT/CN2008/072747

(87) International publication number:
WO 2009/065333 (28.05.2009 Gazette 2009/22)

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MT NL NO PL PT RO SE SI SK TR
Designated Extension States:
AL BA MK RS

(30) Priority: **12.11.2007 CN 200710186456**

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(54) METHOD FOR SENDING PHYSICAL BROADCAST CHANNEL OF TDD SYSTEM

(57) A method for sending a physical broadcast channel in the TDD system is disclosed, which is: a signal of a physical broadcast channel is not sent in a pilot position, and the signal of the physical broadcast channel is sent on 4 OFDM symbols of the first subframe of one radio frame. Through the present invention, the extension requirement of the physical broadcast channel capacity in the TDD can be met, and the system complexity is reduced due to the normal cyclic prefix and extended prefix using the same sending method.

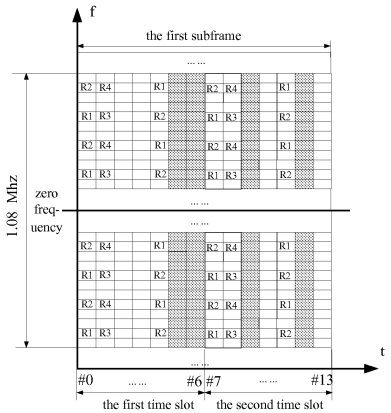


Fig.12

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Description

Field of the Invention

[0001] The present invention relates to the field of mobile communication, in particular to a method for sending a physical broadcast channel in a Time Division Duplex system.

Background of the Invention

[0002]

Fig.1 shows the frame structure of a Frequency Division Duplex (FDD for short) model in the Long Time Evolution (LTE for short). As shown in Fig.1, in such a frame structure, a 10 ms radio frame is divided into two half frames, each half frame is partitioned into 10 time slots of 0.5 ms, and two time slots compose a subframe of 1 ms, thus one half frame comprises 5 subframes. When the cyclic prefix is a normal cyclic prefix, one time slot comprises 7 uplink/downlink symbols; when the cyclic prefix is an extended cyclic prefix, one time slot comprises 6 uplink/downlink symbols, and a Second-Synchronization Channel (S-SCH for short) and a Primary-Synchronization Channel (P-SCH for short) are arranged to be transmitted on the last two OFDM symbols of the first time slot. When the cyclic prefix is a normal cyclic prefix, the Physical Broadcast Channel (PBCH for short) is sent on the 4^{th} and 5^{th} OFDM symbols of the first time slot, and the 1^{st} and 2^{nd} OFDM symbols of the second time slot; when the cyclic prefix is an extended cyclic prefix, the physical broadcast channel is sent on the 4^{th} OFDM symbol of the first time slot and the 1^{st}, 2^{nd}, and 3^{rd} OFDM symbols of the second time slot.

Fig.2 shows the frame structure of the Time Division Duplex (TDD for short) model in the LTE system. As shown in Fig.2, in such a frame structure, one radio frame of 10 ms is divided into two half frames, each half frame is partitioned into 10 time slots of 0.5 ms, and two time slots compose a subframe of 1 ms, thus one half frame comprises 5 subframes. When the cyclic prefix is a normal cyclic prefix, one time slot comprises 7 uplink/downlink symbols; when the cyclic prefix is an extended cyclic prefix, one time slot comprises 6 uplink/downlink symbols. As shown in Fig.2, the subframe of such a frame structure has a configuration characteristic as follows:

Subframe 0 is fixedly used for downlink transmission;

Subframe 1 is a special subframe and comprises 3 special time slots respectively being a DwPTS (Downlink Pilot Time Slot), a GP (Guard Period) and an UpPTS (Uplink Pilot Time Slot), wherein the DwPTS is used for downlink transmission, the P-SCH is arranged to be sent on the first OFDM symbol of the DwPTS, and the S-SCH is arranged to be sent on the last OFDM symbol of the downlink time slot next to the DwPTS.
the GP is the Guard Period in which no data is transmitted.
the UpPTS is used for uplink transmission and comprises at least 2 uplink SC-FDMA symbols for transmitting the Physical Random Access Channel (PRACH for short).

[0003] From the aspects described hereinafter, it can be found that the method for sending the physical broadcast channel in the FDD is already unsuitable for sending the physical broadcast channel in the TDD.

[0004] The physical broadcast channel in the TDD requires more capacity than that in the FDD, thus the method for sending the physical broadcast channel in the FDD can not meet the physical broadcast channel capacity requirement in the TDD;

[0005] In order to use a synchronization signal for channel estimation in the FDD, the physical broadcast channel is configured to be sent before and after the synchronization signal. The sending positions of the synchronization signal are different due to the difference between the TDD frame structure and the FDD frame structure, thus the sending method in the FDD is unsuitable in the TDD;

[0006] The method for sending the physical broadcast channel in the FDD in case of the cyclic prefix being a normal cyclic prefix is different from that in case of the cyclic prefix being an extended cyclic prefix, which also increases the system complexity.

[0007] Therefore, it is desirable to design a new method for sending the physical broadcast channel aiming at the TDD frame structure.

Summery of the Invention

[0008] Considering there is no suitable method for sending the physical broadcast channel in the TDD, the present invention provides a method for sending the physical broadcast channel in the TDD system to solve the above problem.

[0009] The present invention provides a method for sending the physical broadcast channel in the TDD system aiming at the TDD frame structure, which is mainly **characterized in that**:

[0010] The physical broadcast channel is sent in the middle 1.08MHz of the whole frequency band, wherein a signal of a physical broadcast channel is not sent in a pilot position, no matter the cyclic prefix is a normal cyclic prefix or an extended cyclic prefix, the same sending method is utilized for the physical broadcast channel in the TDD; and the physical broadcast channel is sent on 4 OFDM symbols of the first subframe of one radio frame.

[0011] The physical broadcast channel is sent on 4 continuous OFDM symbols of the first subframe of one radio frame, the specific sending method has the following configurations:

Manner 1
sent on the fifth last, fourth last, third last and second last OFDM symbols of the second time slot;

Manner 2
sent on the first, second, third and fourth OFDM symbols of the second time slot;

Manner 3
sent on the second last OFDM symbol, last OFDM symbol of the first time slot, and the first and second OFDM symbols of the second time slot;

Manner 4
sent on the sixth last, fifth last, fourth last and third last OFDM symbols of the second time slot;

Manner 5
sent on the last OFDM symbol of the first time slot, and the first, second and third OFDM symbols of the second time slot;

Manner 6
sent on the third last, second last and last OFDM symbols of the first time slot, and the first OFDM symbol of the second time slot;
or,
the physical broadcast channel can be sent on 4 discontinuous OFDM symbols of the first subframe of the radio frame, the specific sending method has the following configurations:

Manner 1
sent on the third last OFDM symbol of the first time slot, and the third last, the first and second OFDM symbols of the second time slot;

Manner 2
sent on the last, second last OFDM symbols of the first time slot, and the second last and the third OFDM symbol OFDM symbols of the second time slot.

[0012] All the above methods fully take advantage of the characteristics of the TDD frame structure, thus, they can be well applied in the TDD and meet the extension requirement of the physical broadcast channel capacity in the TDD. At the same time, the system complexity is reduced due to the normal cyclic prefix and extended cyclic prefix utilizing the same sending method.

Brief Description of Drawings

[0013] The drawings illustrated here provide a further understanding of the present invention and form a part of the present application. The exemplary embodiments and the description thereof are used to explain the present invention without unduly limiting the scope of the present invention, wherein:

Fig.1 is a schematic view of the frame structure of the FDD in the LTE system;

Fig.1 is a schematic view of the frame structure of the TDD in the LTE system;

Fig.3-Fig.12 are schematic views of concrete sending embodiments for the physical broadcast channel in the TDD of the LTE system.

Detailed Description of Embodiments

Functionality Overview

[0014] Considering that there is no suitable method for sending the physical broadcast channel in the TDD, in the technical scheme of the present embodiment, the physical broadcast channel is sent in the middle 1.08 MHz of the whole frequency band, wherein the signal of the physical broadcast channel is not sent in the pilot position, no matter the cyclic prefix is a normal one or an extended one, the same sending method is utilized for the physical broadcast channel in the TDD; and the physical broadcast channel is sent on 4 OFDM symbols of the first subframe of one radio frame, thus the above-mentioned problem is solved. The above technology scheme fully takes advantage of the characteristics of the TDD frame structure, and is capable of meeting the extension requirement of the physical broadcast channel capacity in the TDD. At the same time, the system complexity is reduced due to the normal cyclic prefix and extended cyclic prefix utilizing the same sending method.

[0015] In order to thoroughly understand the present invention, some concrete embodiments comprising the signal sending method according to the present invention are given in connection with Figs 3-12. Wherein, the physical broadcast channel occupies 1.08 MHz system frequency band centered at zero frequency in frequency domain, and the transmission location is at the first subframe of one radio frame. Figs 3-6 show the specific sending time of the physical broadcast channel in the first sub frame, wherein the first subframe comprises 2 time slots (the first time slot and the second time slot in the radio frame). When the cyclic prefix is a normal cyclic prefix, one time slot contains 7 symbols, when the cyclic prefix is an extended one, one time slot contains 6 symbols, and the S-SCH is sent on the last symbol of the first subframe. As shown in Figs 3-12, R1 denotes the pilot on the first antenna port, R2 denotes the pilot on the second antenna port, R3 denotes the pilot on the third antenna port, R4 denotes the pilot on the fourth antenna port, and the shadow part denotes the physical broadcast channel.

Fig.3 is a schematic view of the sending embodiment for the physical broadcast channel in the TDD of the LTE system. In this embodiment, the cyclic prefix is a normal cyclic prefix, the physical channel is sent on the fifth last, fourth last, third last and second last OFDM symbols of the second time slot.

Fig.4 is a schematic view of the sending embodiment for the physical broadcast channel in the TDD of the LTE system. In this embodiment, the cyclic prefix is an extended cyclic prefix, and the physical channel is sent on the fifth last, fourth last, third last and second last OFDM symbols of the second time slot.

Fig.5 is a schematic view of the sending embodiment for the physical broadcast channel in the TDD of the LTE system. In this embodiment, the cyclic prefix is a normal cyclic prefix, and the physical channel is sent on the first, second, third and fourth OFDM symbols of the first time slot.

Fig.6 is a schematic view of the sending embodiment for the physical broadcast channel in the TDD of the LTE system. In this embodiment, the cyclic prefix is an extended cyclic prefix, and the physical channel is sent on the first, second, third and fourth OFDM symbols of the second time slot.

Fig.7 is a schematic view of the sending embodiment for the physical broadcast channel in the TDD of the LTE system. In this embodiment, the cyclic prefix is a normal cyclic prefix, the physical channel is sent on the second last and last OFDM symbols of the first time slot, and the first and second OFDM symbols of the second time slot.

Fig.8 is a schematic view of the sending embodiment for the physical broadcast channel in the TDD of the LTE system. In this embodiment, the cyclic prefix is a normal cyclic prefix, the physical channel is sent on the sixth last, fifth last, fourth last and third last OFDM symbols of the second time slot.

Fig.9 is a schematic view of the sending embodiment for the physical broadcast channel in the TDD of the LTE system. In this embodiment, the cyclic prefix is a normal cyclic prefix, the physical channel is sent on the last OFDM symbol of the first time slot, and the first, second and third OFDM symbols of the second time slot.

Fig.10 is a schematic view of the sending embodiment for the physical broadcast channel in the TDD of the LTE system, In this embodiment, the cyclic prefix is a normal cyclic prefix, the physical channel is sent on the third last, second last and last OFDM symbols of the first time slot, and the first OFDM symbol of the second time slot.

Fig.11 is a schematic view of the sending embodiment for the physical broadcast channel in the TDD of the LTE system. In this embodiment, the cyclic prefix is a normal cyclic prefix, the physical channel is sent on the third last OFDM symbol of the first time slot, and the first, second and the third OFDM symbols of the second time slot.

Fig.12 is a schematic view of the sending embodiment for the physical broadcast channel in the TDD of the LTE system. In this embodiment, the cyclic prefix is a normal cyclic prefix, the physical channel is sent on the last and the second last OFDM symbols of the first time slot, and the second last and the third OFDM symbols of the second time slot.

[0016] Based on above description, the present invention sends the physical broadcast channel in the middle 1.08 MHz of the whole frequency band, wherein the signal of the physical broadcast channel is not sent in the pilot position, no matter the cyclic prefix is a normal one or an extended one, the same sending method is utilized for the physical broadcast channel in the TDD; and the physical broadcast channel is sent on 4 OFDM symbols of the first subframe of one radio frame, thus the above-mentioned problem is solved. The above technical scheme fully takes advantage of the characteristics of the TDD frame structure, and is capable of meeting the extension requirement of the physical broadcast channel capacity in the TDD. At the same time, the system complexity is reduced due to the normal cyclic prefix and extended cyclic prefix utilizing the same sending method.

[0017] Above description is only to illustrate the preferred embodiments but not to limit the present invention. Various alterations and changes to the present invention are apparent to those skilled in the art. The scope defined in claims shall comprise any modification, equivalent substitution and improvement within the spirit and principle of the present invention.

Claims

1. A method for sending the physical broadcast channel in the TDD system, **characterized in that** a signal of a physical broadcast channel is not sent in a pilot position, and the signal of the physical broadcast channel is sent on 4 OFDM symbols of the first subframe of one radio frame.

2. The method according to Claim 1, **characterized in that** the physical broadcast channel is sent in the middle 1.08MHz of the whole frequency band.

3. The method according to Claim 1, **characterized in that** the physical broadcast channel is sent on four continuous OFDM symbols of the first subframe of one radio frame.

4. The method according to Claim 3, **characterized in that** when the cyclic prefix is a normal cyclic prefix or an extended cyclic prefix, the physical broadcast channel is sent on the following four continuous OFDM symbols of the first subframe of the radio frame,
the fifth last, fourth last, third last and second last OFDM symbols of the second time slot.

5. The method according to Claim 3, **characterized in that** when the cyclic prefix is a normal cyclic prefix or an extended cyclic prefix, the physical broadcast channel is sent on the following four continuous OFDM symbols of the first subframe of the radio frame,
the first, second, third and fourth OFDM symbols of the second time slot.

6. The method according to Claim 3, **characterized in that** when the cyclic prefix is a normal cyclic prefix or an extended cyclic prefix, the physical broadcast channel is sent on the following four continuous OFDM symbols of the first subframe of the radio frame,
the second last, last OFDM symbols of the first time slot, and the first and second OFDM symbols of the second time slot.

7. The method according to Claim 3, **characterized in that** when the cyclic prefix is a normal cyclic prefix or an extended cyclic prefix, the physical broadcast channel is sent on the following four continuous OFDM symbols of the first subframe of the radio frame,
the sixth last, fifth last, fourth last and third last OFDM symbols of the second time slot.

8. The method according to Claim 3, **characterized in that** when the cyclic prefix is a normal cyclic prefix or an extended cyclic prefix, the physical broadcast channel is sent on the following four continuous OFDM symbols of the first subframe of the radio frame,
the last OFDM symbol of the first time slot, and the first, second and third OFDM symbols of the second time slot.

9. The method according to Claim 3, **characterized in that** when the cyclic prefix is a normal cyclic prefix or an extended cyclic prefix, the physical broadcast channel is sent on the following four continuous OFDM symbols of the first subframe of the radio frame,
the third last, second last and last OFDM symbols of the first time slot, and the first OFDM symbol of the second time slot.

10. The method according to Claim 1, **characterized in that** the physical broadcast channel is sent on four discontinuous OFDM symbols of the first subframe of the radio frame.

11. The method according to Claim 10, **characterized in that** when the cyclic prefix is a normal cyclic prefix or an extended cyclic prefix, the physical broadcast channel is sent on the following four discontinuous OFDM symbols of the first subframe of the radio frame,
the third last OFDM symbol of the first time slot, and the third last, the first and second OFDM symbols of the second time slot.

12. The method according to Claim 10, **characterized in that** when the cyclic prefix is a normal cyclic prefix or an extended cyclic prefix, the physical broadcast channel is sent on the following four discontinuous OFDM symbols of the first subframe of the radio frame,
the last, second last OFDM symbols of the first time slot, and the second last and the third OFDM symbols of the second time slot.

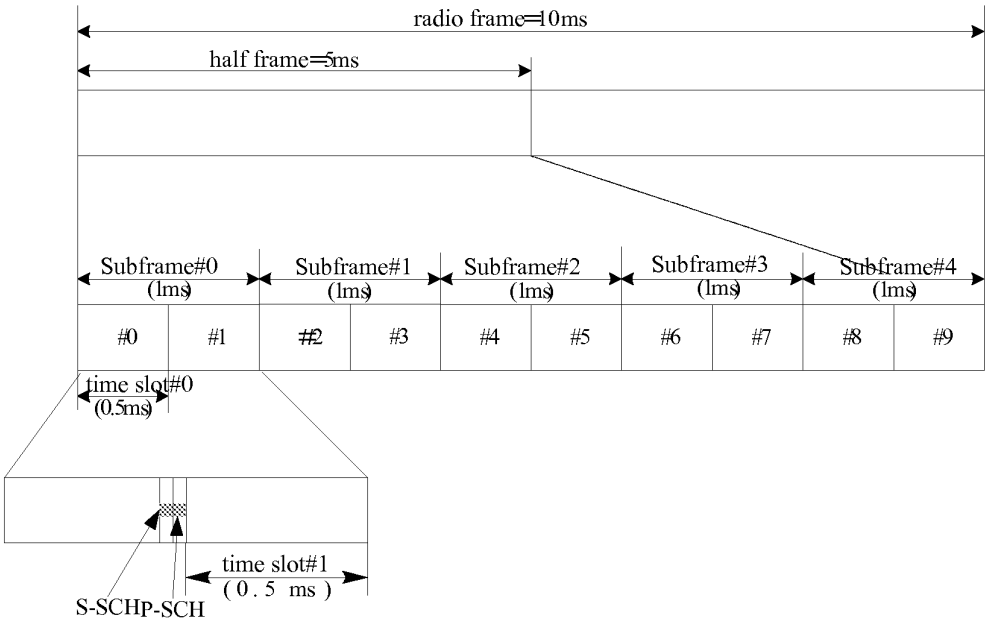

radio frame=10ms
half frame=5ms
Subframe#0 (1ms)
Subframe#1 (1ms)
Subframe#2 (1ms)
Subframe#3 (1ms)
Subframe#4 (1ms)
#0
#1
#2
#3
#4
#5
#6
#7
#8
#9
time slot#0 (0.5ms)
time slot#1 (0 . 5 ms)
S-SCH
P-SCH

Fig.1

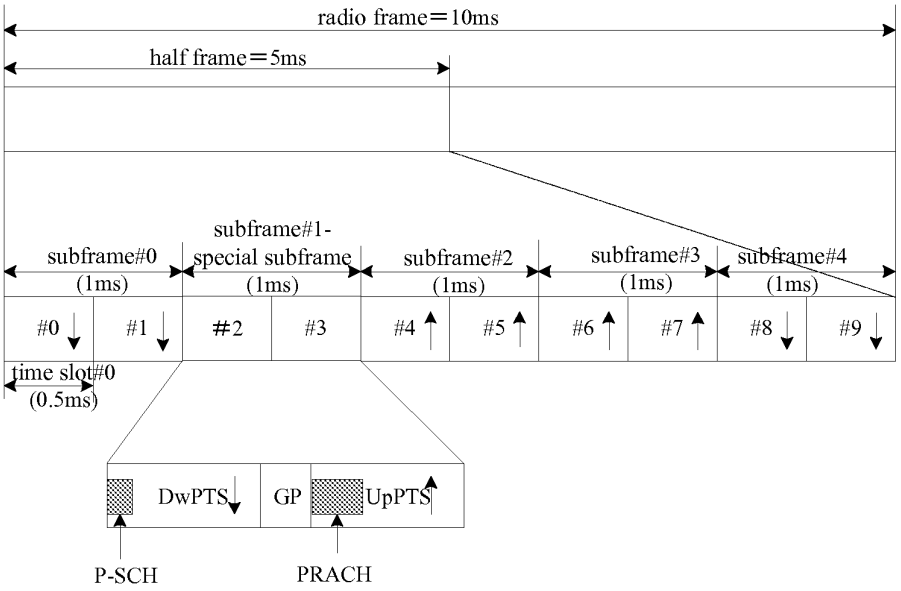

radio frame=10ms
half frame=5ms
subframe#0 (1ms)
subframe#1-special subframe (1ms)
subframe#2 (1ms)
subframe#3 (1ms)
subframe#4 (1ms)
#0
#1
#2
#3
#4
#5
#6
#7
#8
#9
time slot#0 (0.5ms)
DwPTS
GP
UpPTS
P-SCH
PRACH

Fig.2

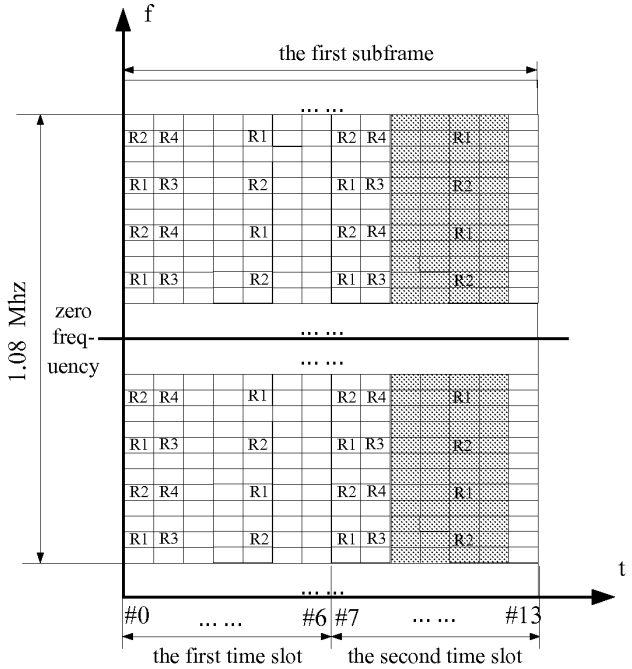

f
the first subframe
1.08 Mhz
zero
freq-
uency
t
#0
#6
#7
#13
the first time slot
the second time slot

Fig.3

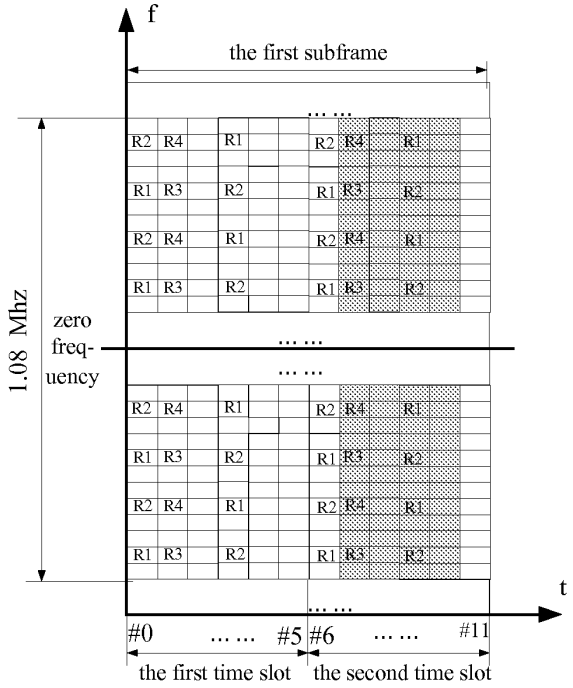

f
the first subframe
1.08 Mhz
zero
freq-
uency
t
#0
#5
#6
#11
the first time slot
the second time slot

Fig.4

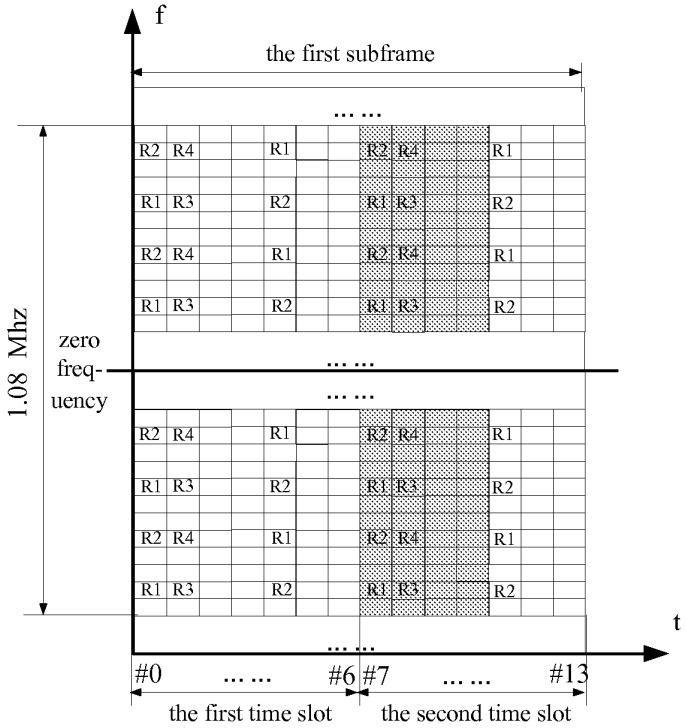

f
the first subframe
1.08 Mhz
zero
freq-
uency
t
#0
#6
#7
#13
the first time slot
the second time slot

Fig.5

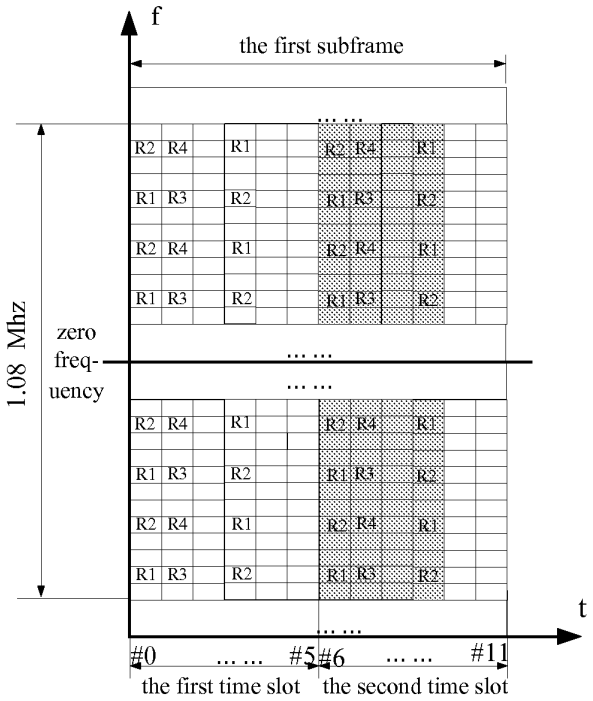

f
the first subframe
1.08 Mhz
zero
freq-
uency
t
#0
#5
#6
#11
the first time slot
the second time slot

Fig.6

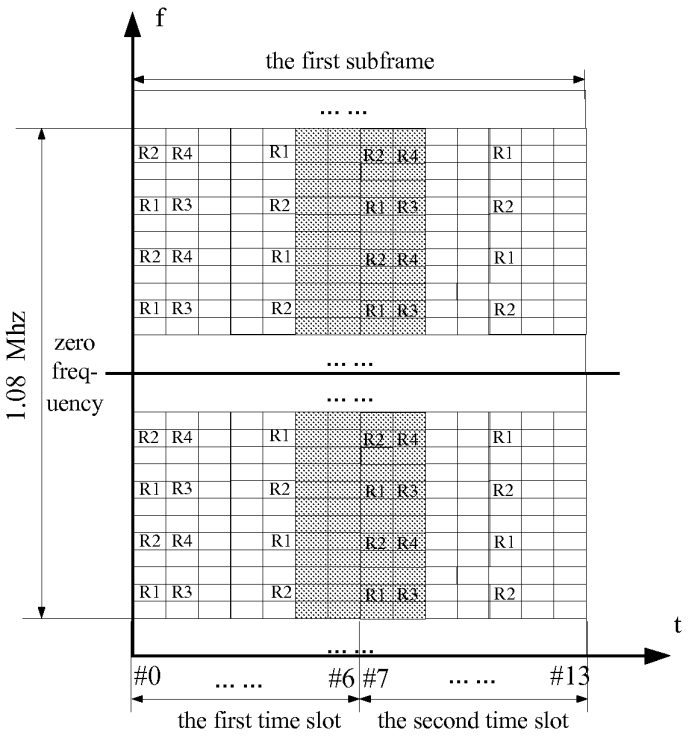

f
the first subframe
1.08 Mhz
zero
freq-
uency
t
#0
#6
#7
#13
the first time slot
the second time slot

Fig.7

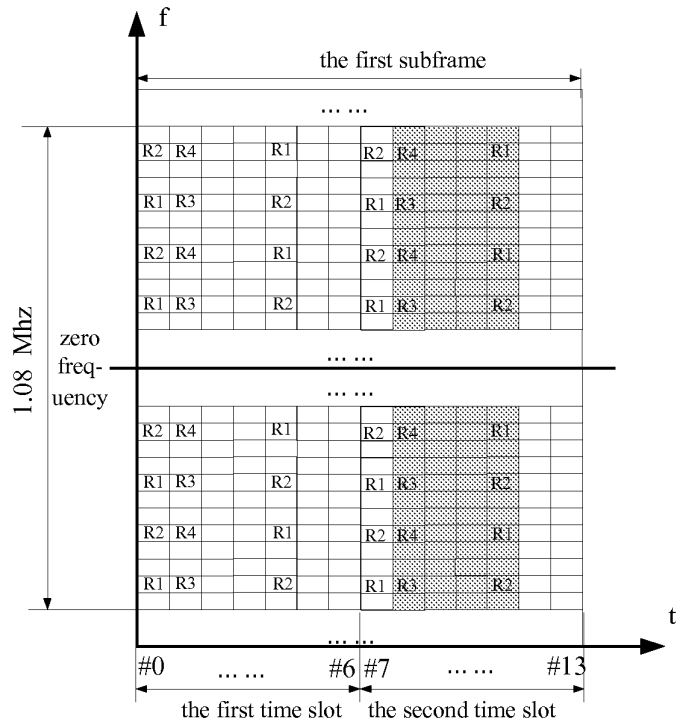

f
the first subframe
1.08 Mhz
zero
freq-
uency
t
#0
#6
#7
#13
the first time slot
the second time slot

Fig.8

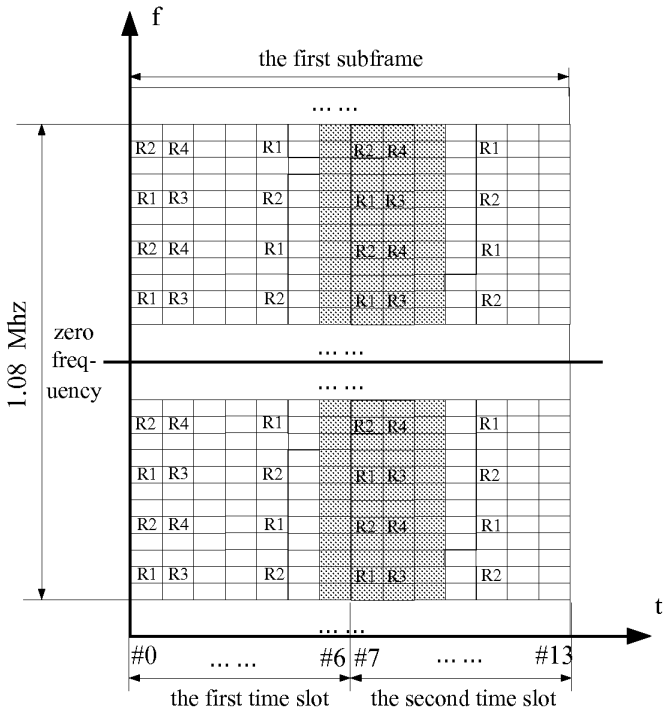

f
the first subframe
1.08 Mhz
zero
freq-
uency
t
#0
#6
#7
#13
the first time slot
the second time slot

Fig.9

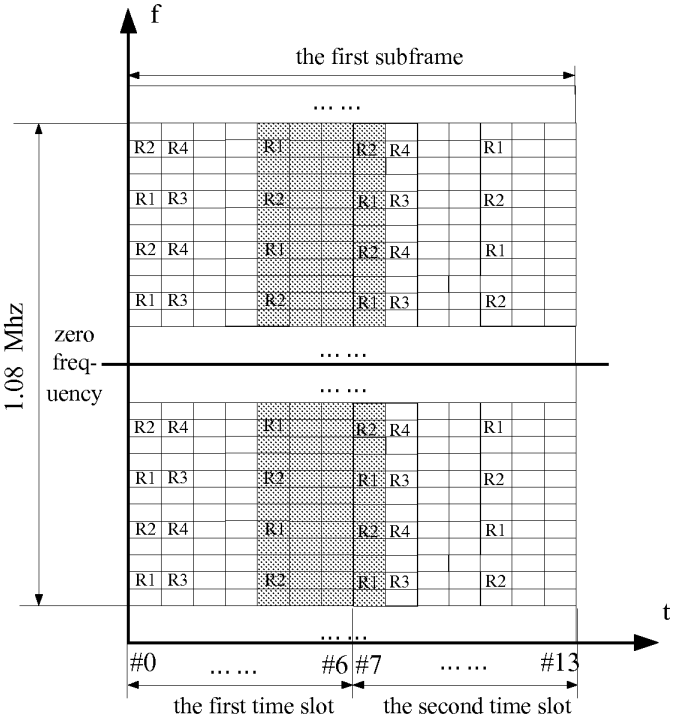

f
the first subframe
1.08 Mhz
zero
freq-
uency
t
#0
#6
#7
#13
the first time slot
the second time slot

Fig.10

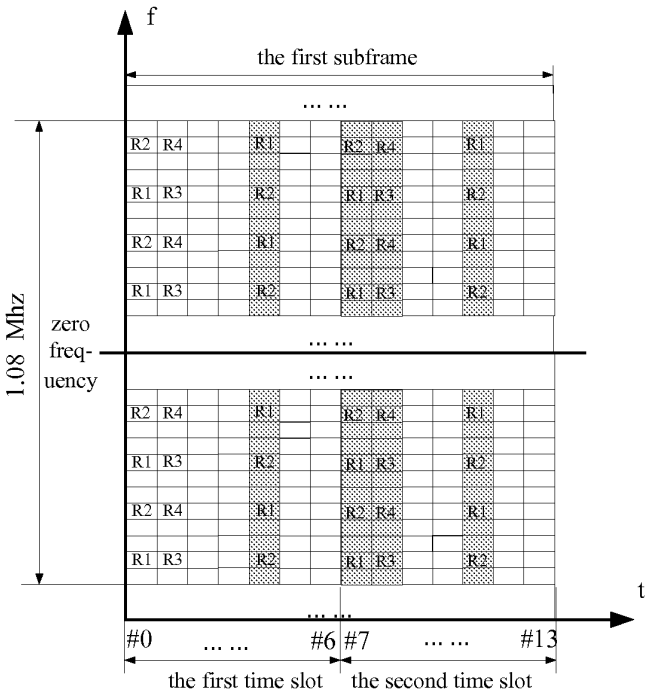

f
the first subframe
... ...
R2 R4 R1 R2 R4 R1
R1 R3 R2 R1 R3 R2
R2 R4 R1 R2 R4 R1
R1 R3 R2 R1 R3 R2
1.08 Mhz
zero
freq-
uency
... ...
... ...
R2 R4 R1 R2 R4 R1
R1 R3 R2 R1 R3 R2
R2 R4 R1 R2 R4 R1
R1 R3 R2 R1 R3 R2
t
... ...
#0 ... ... #6 #7 ... ... #13
the first time slot
the second time slot

Fig.11

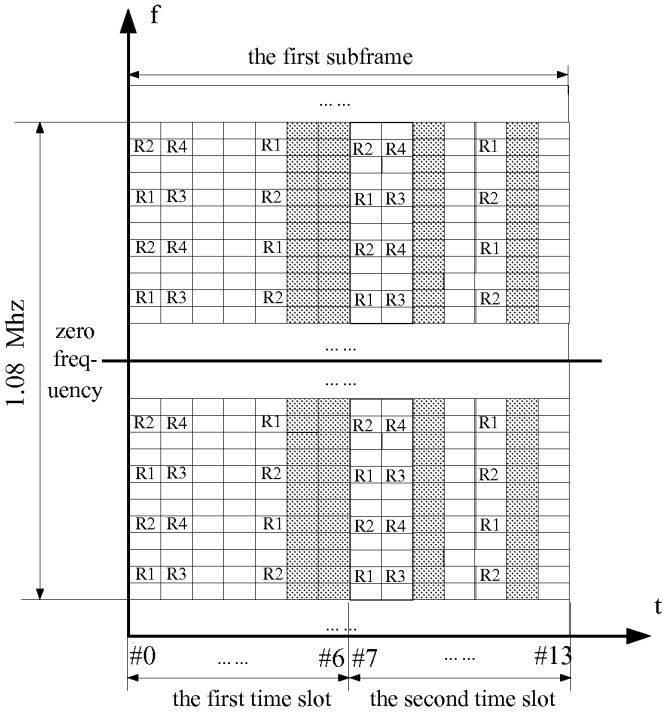

f
the first subframe
... ...
R2 R4 R1 R2 R4 R1
R1 R3 R2 R1 R3 R2
R2 R4 R1 R2 R4 R1
R1 R3 R2 R1 R3 R2
1.08 Mhz
zero
freq-
uency
... ...
... ...
R2 R4 R1 R2 R4 R1
R1 R3 R2 R1 R3 R2
R2 R4 R1 R2 R4 R1
R1 R3 R2 R1 R3 R2
t
... ...
#0 ... ... #6 #7 ... ... #13
the first time slot
the second time slot

Fig.12

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2008/072747

A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC：H04B, H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI,EPODOC,PAJ,CNPAT,CNKI,IEEE,3GPP：TDD,FDD,radio frame, PBCH, frame structure, pilot, subframe, OFDM, normal cyclic prefix, extended cyclic prefix, time slot

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN101159488A(ZTE CORPORATION) 09 Apr.2008(09.04.2008) claims 1-12	1-12
A	TSG-RAN WG1 #51, R1-074762(CMCC ET AL.) (05-09) Nov.2007 ((05-09).11.2007） part 2&figure 1	1-12
A	3GPP TSG RAN WG1 Meeting #50bis，R1-074067 (SAMSUNG) (08-12) Oct.2007((08-12).10.2007) the whole document	1-12
A	3GPP TSG RAN WG1 #51 Meeting,R1-074861 (NOKIA SIEMENS NETWORKS ET AL.) (05-09) Nov.2007 ((05-09).11.2007）the whole document	1-12

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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"&"document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25 Dec.2008（25.12.2008）	**22 Jan. 2009 (22.01.2009)**
Name and mailing address of the ISA/CN The State Intellectual Property Office, the P.R.China 6 Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China 100088 Facsimile No. 86-10-62019451	Authorized officer ZHANG,Pu Telephone No. (86-10)62413126

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2008/072747

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	3GPP TR 25.814 V7.1.0 (3GPP), Sep.2006（09.2006） the whole document	1-12
A	CN101047685A(HUAWEI TECHNOLOGIES CO.,LTD.) 03 Oct.2007(03.10.2007） the whole document	1-12

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
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Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN101159488A	09.04.2008	NONE	
CN101047685A	03.10.2007	NONE	

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2008/072747

Continuation of : CLASSIFICATION OF SUBJECT MATTER

H04B7/26(2006.01)i
H04L27/00(2006.01)i

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